

NAVIGATION CHANNEL IMPROVEMENT ON THE MISSISSIPPI RIVER USING BENDWAY WEIRS

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Introduction. Since 1989, river engineers in the United States have implemented new navigation channel improvement structures on the Mississippi River. These structures are called Bendway Weirs. By 1998, over 155 of these structures have been placed in 15 different bends of the Mississippi River. This paper will summarize the positive economic and environmental impacts Bendway Weirs have provided to the citizens of the United States.

Description. Bendway Weirs are submerged rock structures placed directly in the navigation channel beneath passing barge traffic (Figure 1). The structures are usually constructed in bends or curved reaches of the Mississippi River where encroaching point bars (Figure 2) occur. They are designed to eliminate or alleviate many problems associated with bends including maintenance dredging (Figure 3), accidents (Figure 4), and transit delays associated with traffic bottlenecks.

Bendway Weirs are angled upstream 20 to 30 degrees to a line drawn perpendicular to the low flow thalweg. The structures are designed to negate the development of secondary currents found in curved channels and to redistribute flow for desired sediment management. Bendway Weirs encourage deposition of bed material on the outside of the bend and scour of bed material on the inside of the bend. The resulting redistribution of velocity currents produces a wider and safer navigation channel through the bend.

Prototype Monitoring. Bathymetry and velocity data collected in the prototype have indicated positive effects since construction (Figures 5 and 6). The surveys reflected in the figures are the result of using global positioning, multi-swath technology and acoustic Doppler profiling.

Improved Conditions in Bends. Since the first Bendway Weir was constructed in the river, there has been a steady, favorable trend toward improved navigation conditions. The resulting increased navigation widths and measured redistribution of velocity have enabled downbound barge pilots to steer through the bends rather than flank. The changed conditions have virtually eliminated dredging (Figure 7), substantially reduced traffic accidents (Figure 8), and have made for a safer and more reliable navigation channel. The wider widths have also deterred the formation of ice jams during winter months. The economic

benefits of these positive impacts initiated from these structures have already far exceeded the costs.

Environmental Impacts. Fish habitat has been drastically improved in bends as a result of Bendway Weirs (Figure 9). Bends incorporating the use of these structures have experienced, on the average, a tenfold increase in fish population as compared to bends with no structures in place. The structures provide increased surface area and wetted perimeter and act as underwater, freshwater reefs, inducing the colonization of micro and macro invertebrates. The improved habitat and food chain composite has attracted a variety of fish species, including catfish, sturgeon, paddlefish, drum, madtom, and many other fish species indigenous to the Mississippi River.

Future Work. Bendway Weir structures are proposed for other troublesome reaches in the Mississippi River, and work will continue far out into the future. The structures are also being used for bank stabilization on many rivers and streams of the Central United States.